The little town of Trapp, at the immediate foot of the Blue Ridge on the Loudoun County (east) side, and about one and one-third miles from the Weather Bureau station, is over 1000 feet lower, its elevation above sea level being less than 700 feet. On the west side of the mountain the fall is less abrupt. According to the U. S. Geological Survey contour map the distance from the Mount Weather station to the nearest point on the Shenandoah River is about three miles, and the elevation of the river is between 300 and 400 feet. More exact determinations in the Shenandoah Valley will no doubt be made later.

## THE PROPOSED COMPETITION IN FORECASTING AT LIEGE.

[Translation.]

UNIVERSITY OF CLERMONT,
METEOROLOGICAL OBSERVATORY OF PUY DE DOME,
CLERMONT-FERRAND, *January 27, 1905.*

Prof. WILLIS L. MOORE,
*Chief U. S. Weather Bureau, Washington, D. C.*

SIR: You have been pleased to communicate to me the letter written by you on January 7, last, to Mr. Jacobs, president of the Belgian Astronomical Society[1], in reply to the letter in which he invited you to become a member of an international jury charged with judging in a competition in weather forecasting which the Belgian Astronomical Society proposes to organize.

In accordance with your desire, I hasten to give on the subject the views which you do me the honor to request.

First of all, I had nothing to do with the editing of the document, or rather the proposed document, which was sent to us, and in forwarding my acceptance to Mr. Jacobs I made some express reservations and indicated especially that, in my opinion, the jury, when definitely constituted, should alone be qualified to decide upon the programme. I even made my acceptance conditional upon that of Mr. Teisserenc de Bort; convinced as I was in advance that if that eminent scientist consented to make one of the jury, his influence would be sufficient to have erased from the proposed programme whatever might be unscientific and give rise to well founded opposition.

I had not been consulted either as to my possible participation in the jury, and I should not have failed to protest—as you have done—if they had given my name as a member of the jury in a printed document destined to be given to the public; but I understood that it was only a proposed programme, and that in making use of my name in a printed proof I was left perfectly free to accept or to decline the invitation, and it was the same with all the others whose names appeared with mine.

Having given these preliminary explanations, it is very easy for me to tell you how heartily I am in accord with you as to the injury that is done to science by these fantastic prophets who, without any knowledge of the general movements of the atmosphere, forecast the coming weather somewhat after the manner of those who tell fortunes with cards, and whose blunders do not succeed in exhausting the credulity of the the public. It is necessary at any cost to prevent these from taking any part in a serious competition; and it was, in my opinion, very unfortunate that to the provision for a competition in forecasting for a proximate period they should have added a provision for forecasts several weeks in advance. It is evident that in the present state of science no such prediction can be made scientifically. My intention was to ask, in conjunction with Mr. Teisserenc de Bort, with whose ideas on these subjects I am well acquainted, the absolute elimination of this part of the programme, or rather this "side issue" added to the programme. I thought, however, that this side of the question could be more advantageously discussed when the jury had been constituted.

Again, I entirely agree with your view and those of Mr. Pernter when you say that it would be impossible to accept results, even if they should be excellent in themselves and verified by experience later, without knowing the methods by which they have been obtained; and I am firmly convinced that no prize should be adjudged to a metorologist for forecasts for very short periods in advance, unless he explains the details of his methods in such a way that afterwards any one else may be able to make use of it just as well as he.

The point upon which I take the liberty of differing with you, however, is in regard to the utility of a practical test by the author himself of a method of short-range forecasting. This question was discussed at the thirty-second meeting of the French Association for the Advancement of Science, held at Angers in 1903; the seventh section (Meteorology and Physics of the Globe), of which I had the honor to be president, formulated the following resolution:

> "The seventh section, impressed by apparently proper methods for increasing the accuracy of weather predictions for short periods in advance, expresses the wish that the administration may give to the authors every facility for applying their methods under the most favorable conditions, and by appropriate tests, such as a competition, should allow competent scientists to pronounce as to the efficacy of these methods."

This resolution was adopted unanimously.

I can not but think that, in the present state of science, the prediction for the immediate future of depressions and centers of high pressure over Europe might be made with more precision than is ordinarily the case. Without entering into personal details, I may say that at this Congress of Angers the Section of Meteorology of the French Association was deeply impressed with the accuracy of certain forecasts applied to past conditions, and the French Association for the Advancement of Science, without itself taking the initiative for a competition, was won over to the idea that if those who think they can improve the methods of forecasting were put to the test and forced to apply their methods to a real prediction it would furnish the means of distinguishing that which is real progress from that which is only a repetition of what has been already done.

We do not lack persons who have general and very rational rules for predictions—to which indeed no objection can be made—but who, when charged with applying these rules, do not succeed in producing anything more than indications that are too vague to be of any real use. If those who think they can do better agree to submit to a severe test, and to explain afterwards their method of procedure, so that, by following them, others can derive profit from it, I can see in this only an excellent opportunity to separate what is serious and worthy to be called scientific from what is not. We must only take precautions. It will be especially necessary to abandon all idea of long-range forecasts, and carefully avoid anything that can furnish grounds for the criticisms—often so well founded—formulated by yourself and Mr. Pernter; but I think that the competition in itself, particularly if scientists of the standing of Mr. Teisserenc de Bort watch over it and exercise a control over its acts, would give rise to an exchange of ideas and discussions that would conduce to progress.

Believe me, dear sir, that this difference of opinion as to the utility of a *competition for forecasts for very short periods* does not prevent me from recognizing the correctness of your remarks, and I beg you to accept the assurance of my highest regard.

(Signed) BERNARD BRUNHES,
*Director of the Observatory.*

[1] *See* Monthly Weather Review, November, 1904, p. 523.

## SOLAR HALO OF FEBRUARY 3, 1905, AT WASHINGTON, D. C.

By ERIC REX MILLER, Weather Bureau.

A solar halo observed at Washington, D. C., on February 3, 1905, deserves mention on account of its permanence and brilliant coloration; and especially because it was accompanied by mock suns or parhelia, a phenomenon very infrequently observed at Washington.

The halo was of the usual 22° radius. No other circles were certainly made out, though some who observed it describe a ' concentric " circle about 4° or 5° outside the halo which may have been an indistinct contact arch. The halo was very highly colored in the part nearest the zenith, but faded to white at its lower portion, where the intensity was much diminished by smoke and haze near the horizon.

The parhelia were situated at the east and west sides of the halo and had about the same altitude as the sun. They were about 4° outside the halo, and not, as they are usually described and drawn, on its circumference. The parhelia exhibited the prismatic colors, red predominating, but no tail or prolongation was observed on either parhelion.

The phenomenon was first seen shortly after noon, but must have been visible for some time before, as it had then attained its greatest intensity. It continued, diminishing gradually in distinctness, until about 3 p. m. when it disappeared on account of increasing thickness in the cloud to which the phenomenon was due.

The appearance of the mock suns outside the halo excited comment, since they are generally described and shown in diagrams as situated on the halo. The theory of the departure of the parhelia from the halo is briefly stated by Loomis, " Meteorology " p. 221, and is given in full by Mascart, " Traite D'Optique," tome 3, p. 486, et seq. In this connection it may be worth while to summarize some of the principal facts in regard to halo phenomena, particularly the halo of 22°.

The halos and other circles are formed by refraction or reflection of sunlight or moonlight by ice crystals floating in the air, or by a combination of refraction and reflection.

Ice crystals, which belong to the hexagonal system of crystalization, refract light in various ways, depending upon the direction of the incident ray with reference to the crystal. The least possible deviation occurs when the ray is in the principal plane of the prism, i. e., perpendicular to its longitudinal axis, and passes through two faces inclined to each other at an angle of 60°, making equal angles with these faces at incidence and emergence. Under these conditions the direction of red light, the least refrangible color, is deviated an angle of 21° 37′ by the ice prism, while violet, the most refrangible color, is deviated 22° 22′.

When the sky is covered with upper clouds composed of ice particles these crystals may, if the air is in a state of agitation, be supposed to be oriented in every possible way with respect to the light from the sun. At a given point, an observer will receive refracted light from all parts of the cloud except from within a circle of 21° 37′ radius surrounding the sun, refracted light from prisms within this circle falling short of the observer. In consequence, the illumination of the sky is increased except within the circular space around the sun.

Sunlight is decomposed by refraction into the colors of the spectrum. In the case under consideration, all the colors will be received from each point of the sky, except within the circle of the halo, on account of the different positions of the ice crystals in the cloud at each point. Except where some particular color is omitted or reinforced the different colors will be superposed in such a manner as to produce white light. Such omission of color occurs at the edge of the unilluminated circle around the sun, the violet light disappearing at 22° 22′ from the sun, followed by the less refrangible colors in succession until at 21° 37′ the red disappears. It is in this manner that the color of the halo is produced.

Bearing in mind the position of a prism necessary to produce minimum deviation, it will readily be seen that the halo is produced by crystals lying in planes perpendicular to a line joining the observer and the sun, the longitudinal axis of each crystal being tangent to the circle of the halo. Necessarily, then, none of these crystals will be vertical except when the sun is at or near the horizon, and even then only those crystals on the sides of the halo at the same altitude as the sun will be vertical.

When the air is tranquil the ice crystals tend to assume that position in which they experience the least resistance in falling through the air. The lateral faces of the acicular crystals and the bases of the lamellar crystals become vertical. When the number of vertical crystals preponderates light reflected from these surfaces produces a white horizontal circle at the same angular altitude as the sun. This is the parhelic circle. The brightness of this circle is further augmented by the light refracted by these crystals, and colors are shown at the points of minimum deviation of the refracted light for the reason that the angle of minimum deviation is different for the different colors, and some being omitted allow the less refrangible to predominate. The mock suns or parhelia are produced in this way.

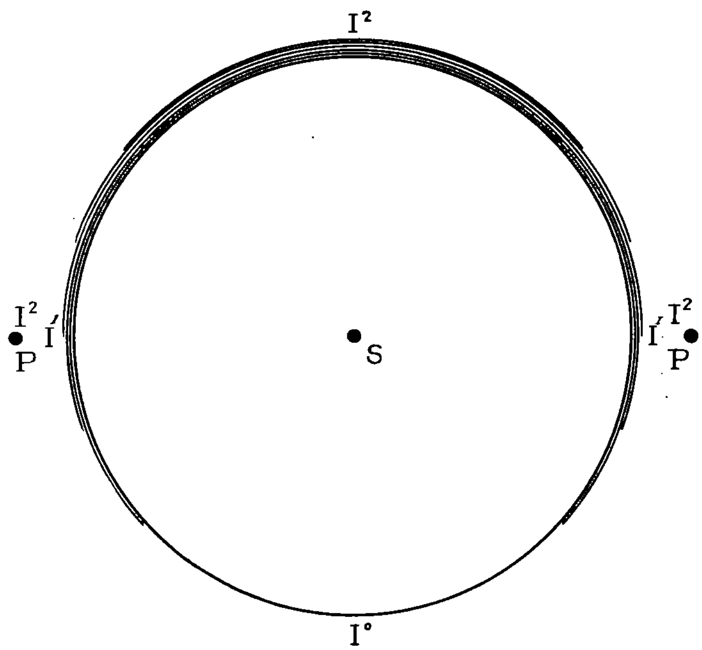

FIG. 1.—Solar halo of February 3, 1905.

The angle between the direction of the sunlight and the principal plane of the vertical prism will be greater as the height of the sun is greater. Now the angle of minimum deviation is increased as the inclination of the incident ray to the principal plane increases; consequently the colors at the point of minimum deviation are seen at a greater distance from the sun and the parhelia are formed outside of the halo when the sun is above the horizon.

TABLE 1.—*Departure of the parhelion from the halo of 22°.*

| Altitude of the sun. | Departure. |
|---|---|
| ° ′ | ° ′ |
| 0 00 | 0 00 |
| 10 00 | 0 18 |
| 20 00 | 1 14 |
| 30 00 | 2 58 |
| 40 00 | 5 48 |
| 50 00 | 10 37 |
| 60 00 | 22 47 |
| 60 45 | 28 14 |

Table 1, from Mascart, shows the departure of the parhelion from the halo for different altitudes of the sun. It will be noticed that up to about 30° this departure is approximately proportional to the square of the sun's altitude, but increases more rapidly for higher altitudes. When the sun is more than 60° 45′ above the horizon the parhelia accompanying the halo of 22° are no longer formed.

In addition to the works previously mentioned valuable articles on halo phenomena will be found in the MONTHLY WEATHER REVIEW for 1897 on pages 294 and 305, and in the volume for 1902, page 317.

## METEOROLOGICAL CHARTS OF THE INDIAN OCEAN.

By CHARLES FITZHUGH TALMAN, Section of Ocean Meteorology, U. S. Weather Bureau.

As one result of the recent transfer of the work in ocean meteorology from the Hydographic Office to the U. S. Weather Bureau, the latter becomes a cooperator in the important studies of the Indian Ocean and adjacent lands, recently undertaken on a large scale by the meteorological service of India. The general plan of this work was outlined by Sir John Eliot, in his notable address before the subsection of Cosmical Physics at the last meeting of the British Association.

The Indian Service published for several years daily synoptic charts of the Indian monsoon area, but the region covered by these charts extended only between 36° north and 12° south latitude. The observations upon which the charts were based were partly made at the shore stations, and partly obtained from meteorological logs of vessels. In view of the vast importance to India of a complete understanding of the conditions which control the monsoon winds and the resultant rainfall, it has been decided to extend the field of observation over the greater part of the Southern Indian Ocean, and also to include broad areas of the surrounding continents and islands.

In order to obtain as many observations as possible from the oceanic areas, and especially from the region of permanent high pressure in the ocean east of Cape Colony, the cooperation of the British, German, and American meteorological services has been requested. These three services are now engaged in securing marine observations from vessels of all nationalities throughout the world. As an indication of the probable number of reports to be furnished by the Weather Bureau, the statement of the Hydrographic Office as to the number of reports of trans-Indian voyages received during the period January 1, 1902, to January 1, 1904, is of interest. The number was 53, and the average time spent within the prescribed area was 51 days, making a total of 2700 observations in 720 days, or approximately four observations a day. To this number, the vessels reporting to the British and German meteorological services, together with those which report direct to the Indian Service, will be added, making up a very respectable total; so that the daily synoptic charts which the Indian Service is to prepare, commencing with January 1, 1905, are likely to present an interesting and valuable picture of the march of weather conditions over this region.

Sir John Eliot says:

> It has been found that the abnormal conditions of the past seven years, with their droughts in Australia, Africa, and India, have been associated with abnormal pressure conditions over a very large portion of the earth's surface; and it is hoped that these charts will enable light to be thrown on a number of questions of scientific interest as well as of economic importance.

The new enterprise of the Indian Meteorological Service appears to be an important step in the direction of "world meteorology," with successful long-range forecasting as its ultimate aim.

## EARTHQUAKES OF JANUARY AND FEBRUARY, 1905.

By PROF. CHARLES F. MARVIN.

The following notes have reference to two slight earthquakes recorded by the Bosch Omori seismograph at the Weather Bureau in January and February of 1905.

The first, while definitely registered was of short duration and only a few of the characteristic features of such records were well developed. The second was a much stronger disturbance.

The detailed times of the usual features follow:

*Earthquakes of January and February, 1905, seventy-fifth meridian time.*

| | January 20, 1905, (p. m.) | | | February 14, 1905, (a. m.) | | |
|---|---|---|---|---|---|---|
| | h. | m. | s. | h. | m. | s. |
| First preliminary tremors began | 1 | 6 | 37 | 4 | 14 | 10 |
| Second preliminary tremors began | 1 | 10 | 58 | 4 | 23 | 00 |
| Principal portion began | 1 | 14 | 38 | 4 | 31 | 21 |
| Principal portion ended | 1 | 20 | 32 | 4 | 35 | 36 |
| End of earthquake | 1 | 29 | 15 | 5 | 20 | 00 |

| | January 20 | | February 14 | |
|---|---|---|---|---|
| Duration of first preliminary tremors | 4 min. | 21 sec. | 8 min. | 50 sec. |
| Duration of second preliminary tremors | 3 " | 40 " | 8 " | 21 " |
| Duration of principal portion | 5 " | 54 " | 4 " | 15 " |
| Total duration of earthquake | 23 " | 38 " | 1 hr. 5 " | 50 " |

| | |
|---|---|
| Average period of definite waves, in preliminary portion | 19.8 sec. |
| Average period of definite waves in principal portion | 17.0 " |
| Period of pendulum | 28.0 " |
| Maximum double amplitude of actual displacement of earth at seismograph | 0.22 mm. |
| Magnification of record | 10 times. |

The earthquake of February 14 was preceded and followed by very perceptible pulsatory oscillations, by which are meant very slight oscillations that are visible throughout nearly the entire record and which have been noticed to occur from time to time without apparent close connection with other observed phenomena. These oscillations tend to render the determination of the times of beginning and ending of the feebler phases of the earthquake inexact.

## DR. J. O. HARRIS.

By WILLIAM G. BURNS, Section Director, U. S. Weather Bureau.

Dr. J. O. Harris, an honored member of the staff of voluntary observers of the Climate and Crop Service of the Illinois Section, died at his home in Ottawa on the morning of January 10, aged 77 years. He was born at Liverpool, Onondaga County, New York, on September 13, 1828. He was a descendant of Revolutionary stock. A graduate in medicine, he entered the Army in 1862 as assistant surgeon of the 53d Illinois infantry. He was public-spirited and identified with every local enterprise. A man of high literary and scientific attainments, as early as 1854 he organized the public library, and his labors in the meteorological field date back to 1853, when he acted as correspondent for the Smithsonian Institution.

Since the organization of the Signal Service in 1870, Doctor Harris has served as voluntary observer, and his labors ceased only with his death.

## RECENT PAPERS BEARING ON METEOROLOGY.

Mr. H. H. KIMBALL, Librarian and Climatologist.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——.

*Nature. London. Vol. 71.*

**Robinson, Edward E.** Super-cooled raindrops. P. 295.

—— Floods in the United States. P. 308.

**MacDowall, Alex. B.** The moon and the barometer. P. 320.

*Knowledge. London. New Series. Vol. 2.*

**Clarke, Agnes M.** Modern cosmogonies. XII. Our own system. Pp. 24-26.

—— The late Rev. J. M. Bacon. P. 31.

**Lockyer, William J. S.** Our sun and "weather." Pp. 33-35.